Quantitative Systems Biotechnology (QSB)

Program Solicitation

NSF 01-37

DIRECTORATE FOR ENGINEERING
- DIVISION OF BIOENGINEERING AND ENVIRONMENTAL SYSTEMS
- DIVISION OF CHEMICAL AND TRANSPORT SYSTEMS
- DIVISION OF CIVIL AND MECHANICAL SYSTEMS
- DIVISION OF DESIGN, MANUFACTURE, AND INDUSTRIAL INNOVATION
- DIVISION OF ELECTRICAL AND COMMUNICATIONS SYSTEMS
- DIVISION OF ENGINEERING EDUCATION AND CENTERS

DEADLINE(S): March 23, 2001

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- **TDD (for the hearing-impaired):** (703) 292-5090
- **To Order Publications or Forms:**

  Send an e-mail to: pubs@nsf.gov

  or telephone: (301) 947-2722
- **To Locate NSF Employees:** (703) 292-5111

SUMMARY OF PROGRAM REQUIREMENTS

GENERAL INFORMATION

Program Title: Quantitative Systems Biotechnology (QSB)

Synopsis of Program: The Engineering Directorate of the National Science Foundation (NSF) announces an Initiative on Quantitative Systems Biotechnology. This initiative seeks innovative high risk/high return research that will yield quantitative models and improved experimental tools to enable the use of genomic data for predicting phenotype or for solidifying the understanding of the design principles of intact unicellular organisms. Channeling the developments into a positive impact on bioprocess analysis, design, and control is sought and participation from different communities adept at complex systems analysis is desired. Several programs within the Engineering Directorate support this initiative.

Cognizant Program Officer(s):

- Fred Heineken, Program Director, Engineering, Bioengineering and Environmental Systems, 565, telephone: 703 292 7944, e-mail: fheineke@nsf.gov.
- Dewey Ryu, Program Director, Bioengineering and Environmental Systems, 565, telephone: 703 292 7945, e-mail: dryu@nsf.gov.
- Michael Domach, Program Director, Bioengineering and Environmental Systems, 565, telephone: 703 292 7941, e-mail: mdomach@nsf.gov.
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- Maria Burka, Program Director, Chemical and Transport Systems, 525, telephone: 703 292 7030, e-mail: mburka@nsf.gov.
- Ronald Rardin, Program Director, Design, Manufacture, and Industrial Innovation, 590, telephone: 703 292 7081, e-mail: rrardin@nsf.gov..
- Paul Werbos, Program Director, Electrical and Communications Systems, 675, telephone: 703 292 8339, e-mail: pwerbos@nsf.gov.
- Tapan Mukherjee, Program Director, Engineering Education and Centers, 585, telephone: 703 292 8381, e-mail: tmukherj@nsf.gov.
- Miriam Heller, Program Director, Civil and Mechanical Systems, 545, telephone: 703 292 8360, e-mail: mheller@nsf.gov.

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.041 --- Engineering

ELIGIBILITY INFORMATION

- **Organization Limit:** U.S. academic and non-profit research institutions with engineering research and education programs are invited to submit proposals.
- **PI Eligibility Limit:** None
- **Limit on Number of Proposals:** None

AWARD INFORMATION

- **Anticipated Type of Award:** Standard or Continuing Grant
- **Estimated Number of Awards:** 10
- **Anticipated Funding Amount:** $4.0 million in FY2001 pending availability of funds

PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

- **Full Proposal Preparation Instructions:** Standard Preparation Guidelines
    - Standard GPG Guidelines apply.

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is Specialized
- **Cost Sharing Level/Amount:** Please see the full program solicitation for further information
- **Indirect Cost (F&A) Limitations:** Not Applicable.
- **Other Budgetary Limitations:** Award amounts are limited to a maximum of $500,000 for up to three years.

C. Deadline/Target Dates

- **Letter of Intent Due Date(s):** None
- **Preproposal Due Date(s):** None
- **Full Proposal Due Date(s):** March 23, 2001

D. FastLane Requirements

- **FastLane Submission:** Full Proposal Required
- **FastLane Contact(s):**
    - Ms. Marcia Rawlings, Program Assistant, Engineering, Bioengineering and Environmental Systems, 565, telephone: 703 292 7956, e-mail: mrawling@nsf.gov.

PROPOSAL REVIEW INFORMATION

- **Merit Review Criteria:** National Science Board approved criteria apply.

AWARD ADMINISTRATION INFORMATION

- **Award Conditions:** Standard NSF award conditions apply.
- **Reporting Requirements:** Standard NSF reporting requirements apply.

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I. INTRODUCTION

Impressive gains in genome sequencing technology and the growing number of completely or nearly sequenced naturally occurring or engineered genomes have generated substantial data. The heightened availability of this genome-level data provides new opportunities for systems-based analyses of cellular systems and biotechnological processes. To address the challenges of relating genotype to phenotype and to accelerate progress towards realizing potential biotechnological opportunities, this program shall support high risk/high return research devoted to developing systems analysis frameworks and data-acquisition systems that hold promise for more efficiently relating genome- and environment-level data to a manifested phenotype.

Phenotype results from the interactions between numerous genes and environmental factors, and so is best understood from a systems approach. The construction and testing of quantitative frameworks, in turn, will be enabled by the collaborative input of bioengineers, complex systems analysts, biologists, and workers from other fields. Such collaborations can creatively contend with the hierarchical and nonlinear nature of cellular systems, while maintaining a focus on directing the research results towards developing and improving cell-based, biotechnological processes. These frameworks are envisioned to involve the use of different system analysis tools (discrete math, differential equations) and model-database integration architectures. Moreover, the engineering design and performance space for quantitative investigation can extend beyond the examples and circumstances provided by nature. Thus, the analysis frameworks and phenotype drivers of interest differentiates this program from a traditional life science activity.

At this juncture, bacteria or engineered bacterial cells are viewed as the most desirable subjects for developing quantitative frameworks. The rationale is more rapid progress is possible when substantial genomic data is combined with the ability to completely define the environmental conditions under which proliferation and gene expression occur. The tools developed could also, in the future, serve as platforms and experience reference points that will be useful for investigating more complex cell types and tissues.

Opportunities and needs also exist with regard to data acquisition systems (e.g. arrays, two-dimensional gels). It would be beneficial, for example, to move beyond the output of data in ratio form so that the information can be more immediately used for model building or testing. New approaches that can provide information that can, for example, link gene array and proteomic data sets are also deemed to be important research objectives.

II. PROGRAM DESCRIPTION

OVERALL GOALS & SCOPE

The ultimate goals of the QSB initiative are

- To better predict physiological function across a broader range of conditions and cell designs and thus engineered bioprocess behavior from knowledge about genomes.
- To gain a more comprehensive interpretation of post-genomic data.
- To unify and advance the understanding of the design principles and options for genomic, post-genomic, and metabolic systems.

These goals can only be reached with non-reductionist modeling approaches and improved data acquisition and integration methods.

In a typical case, it is anticipated that work supported by this initiative would use as components a set of known sequences, whether coding or non-coding, a set of regulators, and/or a number of metabolites and pathways, and connect them in a fashion that would elucidate aspects of their integrated function, coordination, regulation, and role in phenotype determination. The detailed analysis of molecular mechanisms (e.g. ligand binding, protein-protein interactions, and molecular recognition) falls within the scope of QSB if the task is imbedded in an integrated assessment that shows promise for enhancing understanding at the intact system level.

There is no doubt that the identification and characterization of individual genomic or metabolic components is of extreme importance. However, the scope of QSB emphasizes the quantitative interactions between such components and the consequent phenotype. Thus, research focused on molecular component characterization falls outside the scope of QSB. The scope of the QSB initiative also does not embrace a focus on sequencing, genomic data acquisition, or statistical mining. Proposals may include such methodologies only in conjunction with other substantive system modeling tasks. Proposals on new screening strategies and assay technologies are encouraged if they demonstrate novelty and also explicitly address how quantitative modeling efforts will be enabled and pursued.

TOPICAL COMPONENTS

A responsive proposal should state an overarching issue and then present a solution path involving system analysis and/or experimentation. How the issue and solution are linked to improving the quantitative engineering analysis, design, and/or optimization of biotechnological processes should be explained. General topics of interest for a proposal to address are

- Mechanistic-based, quantitative frameworks (*in silico* biotechnology) for assessing phenotypes based on genomic information ***and*** environmental factors.
- Improved experimental screening methods or assays to provide a strengthened basis for building and testing quantitative frameworks.

As described above, analysis and experimentation should be viewed as linked even if a proposed project emphasizes modeling versus experimentation. Bacteria are viewed as the most desirable subject and proposers should keep the aforementioned rationale in mind when formulating a project. Below, additional details are provided on the potential scope of proposal components.

Examples of Engineering Issues: The following questions provide examples of some issues of interest. The examples are not meant to be inclusive; other integrative questions and the technological implications of the answers also merit investigation.

- Is there a limited number of design principles or motifs that govern gene and/or metabolic regulation that can be the basis for bioprocess analysis and design?
- Is it possible to establish a catalog of regulatory "units" or "modules" that can be assembled for the prediction and understanding of larger regulatory circuits?
- How is system performance versus robustness/adaptability managed and traded-off, and

does this limit ultimate bioprocess efficiency?

- Concerning bioprocess control and repeatability, how do properties emerge as a result of initial values, genomic repertoire, and nonlinear interactions between system components, and what is the role of degeneracy?

Mathematical Frameworks: Modeling work can be anticipatory or hypothesis-driven in that one need not delay the development until all necessary data are complete and perfect. The fusion of different computational tools is highly encouraged to address physicochemical, information hierarchies, molecular biology, and other salient features. Such frameworks may combine differential equations, discrete mathematics, and other system analysis tools. Other formalism issues such as revisiting how models connect with data bases to enable the prediction of emergent, branching, and other properties is of interest given a test-bed with biotechnological merit is used.

All models should be tested with respect to robustness and sensitivities in response to changes in parameters to assess if the model outputs are realistic or prone to artifacts. The models should produce testable results and also guide the development of new experiments. It is desirable that the proposed program includes model testing and validation in collaboration with bench scientists.

Screening & Data Acquisition Systems: Methods and strategies that offer increased reliability, reproducibility, and resolution for gene expression and protein profile determination are required. The data provided must have the attribute of being more directly useable for quantitative model development and/or testing. In particular, moving beyond ratio analysis is needed where, for example, the information provided is in the form of molecules per cell, concentration, etc. This may involve inventing new methods or improving the output from existing methods. Apart from screening systems, new biomolecular screening strategies also need to be developed that allow for the link between gene expression (e.g. gene chip) and proteomic data to be more firmly established. Examples include new assay strategies for ascertaining metabolite profiles and second messenger levels.

Subject Systems: Bacteria or engineered bacterial cells are viewed as the most desirable research subjects for progress to be made in the near term while also providing a platform for investigating other biological systems. The genome of the organism (or strain) need not be totally sequenced if the project entails using that organism for proving the concept behind a new screening or assay approach. However, the data-acquisition advances must have high potential for being applicable to organisms with completed genome sequences. Additionally, researchers must be cognizant of potential limitations when focusing on an organism to insure that valid conclusions are drawn and the results are not overly extrapolated. Biological modularity and common design-property relationships may exist, yet there may also be interesting variations when an organism's natural environmental niche versus a synthetic bioprocess (or laboratory) environment is considered. Therefore, some careful advance thinking and interpretative flexibility are desirable attributes of research programs, especially when delineating design rules and general patterns that comprise the goals.

III. ELIGIBILITY INFORMATION

U.S. academic and non-profit research institutions with engineering research and education programs are invited to submit proposals.

IV. AWARD INFORMATION

Funding of up to $4M in FY2001 will be provided by participating NSF Engineering Divisions. There is no obligation to spend this amount if the quality of the proposals reviewed is not high enough to merit support. Estimated program budget, number of awards, and average award size are subject to the availability of funds.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Instructions:

Proposals submitted in response to this program announcement/solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF *Grant Proposal Guide* (GPG). The complete text of the GPG is available electronically on the NSF Web Site at: http://www.nsf.gov/cgi-bin/getpub?nsf012. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (301) 947-2722 or by e-mail from pubs@nsf.gov.

Proposers are reminded to identify the program solicitation number (NSF 01-37) in the program announcement/solicitation block on the NSF Form 1207, *Cover Sheet For Proposal to the National Science Foundation*. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

B. Budgetary Information

50% cost sharing is required for equipment over $20K and up to a maximum of $100K

The proposed cost sharing must be shown on Line M on the proposal budget. Documentation of the availability of cost sharing must be included in the proposal. Only items which would be allowable under the applicable cost principles, if charged to the project, may be included as the awardee's contribution to cost sharing. Contributions may be made from any non-Federal source, including non-Federal grants or contracts, and may be cash or in-kind (see OMB Circular A-110, Section 23). It should be noted that contributions counted as cost-sharing toward projects of another Federal agency may not be counted towards meeting the specific cost-sharing requirements of the NSF award. All cost-sharing amounts are subject to audit. Failure to provide the level of cost-sharing reflected in the approved award budget may result in termination of the NSF award, disallowance of award costs and/or refund of award funds to NSF.

Other Budgetary Limitations: Award amounts are limited to a maximum of $500,000 for up to three years.

C. Deadline/Target Dates

Proposals submitted in response to this announcement/solicitation must be submitted by 5:00

PM, local time on the following date(s):

March 23, 2001

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this Program Solicitation through the FastLane system. Detailed instructions for proposal preparation and submission via FastLane are available at: http://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call 1-800-673-6188.

Submission of Signed Cover Sheets. The signed copy of the proposal Cover Sheet (NSF Form 1207) must be postmarked (or contain a legible proof of mailing date assigned by the carrier) within five working days following proposal submission and be forwarded to the following address:

National Science Foundation
DIS – FastLane Cover Sheet
4201 Wilson Blvd.
Arlington, VA 22230

VI. PROPOSAL REVIEW INFORMATION

A. NSF Proposal Review Process

Reviews of proposals submitted to NSF are solicited from peers with expertise in the substantive area of the proposed research or education project. These reviewers are selected by Program Officers charged with the oversight of the review process. NSF invites the proposer to suggest at the time of submission, the names of appropriate or inappropriate reviewers. Care is taken to ensure that reviewers have no conflicts with the proposer. Special efforts are made to recruit reviewers from non-academic institutions, minority-serving institutions, or adjacent disciplines to that principally addressed in the proposal.

Proposals will be reviewed against the following general review criteria established by the National Science Board. Following each criterion are potential considerations that the reviewer may employ in the evaluation. These are suggestions and not all will apply to any given proposal. Each reviewer will be asked to address only those that are relevant to the proposal and for which he/she is qualified to make judgements.

What is the intellectual merit of the proposed activity?
How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative and original concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?
How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

Principal Investigators should address the following elements in their proposal to provide reviewers with the information necessary to respond fully to both of the above-described NSF merit review criteria. NSF staff will give these elements careful consideration in making funding decisions.

Integration of Research and Education
One of the principal strategies in support of NSF's goals is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities
Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

A summary rating and accompanying narrative will be completed and signed by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, are sent to the Principal Investigator/Project Director by the Program Director. In addition, the proposer will receive an explanation of the decision to award or decline funding.

B. Review Protocol and Associated Customer Service Standard

All proposals are carefully reviewed by at least three other persons outside NSF who are experts in the particular field represented by the proposal. Proposals submitted in response to this announcement/solicitation will be reviewed by Mail Review followed by Panel Review.

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

NSF will be able to tell applicants whether their proposals have been declined or recommended for funding within six months for 95 percent of proposals. The time interval begins on the proposal deadline or target date or from the date of receipt, if deadlines or target dates are not used by the program. The interval ends when the Division Director accepts the Program Officer's recommendation.

In all cases, after programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications and the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at its own risk.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program Division administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See section VI.A. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award letter, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award letter; (4) the applicable award conditions, such as Grant General Conditions (NSF-GC-1)* or Federal Demonstration Partnership (FDP) Terms and Conditions * and (5) any announcement or other NSF issuance that may be incorporated by reference in the award letter. Cooperative agreement awards also are administered in accordance with NSF Cooperative Agreement Terms and Conditions (CA-1). Electronic mail notification is the preferred way to transmit NSF awards to organizations that have electronic mail capabilities and have requested such notification from the Division of Grants and Agreements.

*These documents may be accessed electronically on NSF's Web site at http://www.nsf.gov/home/grants/grants_gac.htm. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (301) 947-2722 or by e-mail from pubs@nsf.gov.

More comprehensive information on NSF Award Conditions is contained in the NSF *Grant Policy Manual* (GPM) Chapter II, available electronically on the NSF Web site at http://www.nsf.gov/cgi-bin/getpub?gpm. The GPM is also for sale through the Superintendent of Documents, Government Printing Office (GPO), Washington, DC 20402. The telephone number at GPO for subscription information is (202) 512-1800. The GPM may be ordered through the GPO Web site at http://www.gpo.gov.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the PI must submit an

annual project report to the cognizant Program Officer at least 90 days before the end of the current budget period.

Within 90 days after the expiration of an award, the PI also is required to submit a final project report. Approximately 30 days before expiration, NSF will send a notice to remind the PI of the requirement to file the final project report. Failure to provide final technical reports delays NSF review and processing of pending proposals for that PI. PIs should examine the formats of the required reports in advance to assure availability of required data.

NSF has implemented an electronic project reporting system, available through FastLane. This system permits electronic submission and updating of project reports, including information on project participants (individual and organizational), activities and findings, publications, and other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system.

VIII. CONTACTS FOR ADDITIONAL INFORMATION

General inquiries regarding Quantitative Systems Biotechnology should be made to:

- Fred Heineken, Program Director, Engineering, Bioengineering and Environmental Systems, 565, telephone: 703 292 7944, e-mail: fheineke@nsf.gov.
- Dewey Ryu, Program Director, Bioengineering and Environmental Systems, 565, telephone: 703 292 7945, e-mail: dryu@nsf.gov.
- Michael Domach, Program Director, Bioengineering and Environmental Systems, 565, telephone: 703 292 7941, e-mail: mdomach@nsf.gov.
- Sohi Rastegar, Program Director, Bioengineering and Environmental Systems, 565, telephone: 703 292 7946, e-mail: srastegar@nsf.gov.
- Maria Burka, Program Director, Chemical and Transport Systems, 525, telephone: 703 292 7030, e-mail: mburka@nsf.gov.
- Ronald Rardin, Program Director, Design, Manufacture, and Industrial Innovation, 590, telephone: 703 292 7081, e-mail: rrardin@nsf.gov..
- Paul Werbos, Program Director, Electrical and Communications Systems, 675, telephone: 703 292 8339, e-mail: pwerbos@nsf.gov.
- Tapan Mukherjee, Program Director, Engineering Education and Centers, 585, telephone: 703 292 8381, e-mail: tmukherj@nsf.gov.
- Miriam Heller, Program Director, Civil and Mechanical Systems, 545, telephone: 703 292 8360, e-mail: mheller@nsf.gov.

For questions related to the use of FastLane, contact:

- Ms. Marcia Rawlings, Program Assistant, Engineering, Bioengineering and Environmental Systems, 565, telephone: 703 292 7956, e-mail: mrawling@nsf.gov.

IX. OTHER PROGRAMS OF INTEREST

The NSF *Guide to Programs* is a compilation of funding for research and education in science, mathematics, and engineering. The NSF *Guide to Programs* is available electronically at http://www.nsf.gov/cgi-bin/getpub?gp. General descriptions of NSF programs, research areas, and eligibility information for proposal submission are provided in each chapter.

Many NSF programs offer announcements or solicitations concerning specific proposal requirements. To obtain additional information about these requirements, contact the appropriate NSF program offices. Any changes in NSF's fiscal year programs occurring after press time for the *Guide to Programs* will be announced in the NSF E-Bulletin, which is updated daily on the NSF web site at http://www.nsf.gov/home/ebulletin, and in individual program announcements/solicitations. Subscribers can also sign up for NSF's Custom News Service (http://www.nsf.gov/home/cns/start.htm) to be notified of new funding opportunities that become available.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) funds research and education in most fields of science and engineering. Awardees are wholly responsible for conducting their project activities and preparing the results for publication. Thus, the Foundation does not assume responsibility for such findings or their interpretation.

NSF welcomes proposals from all qualified scientists, engineers and educators. The Foundation strongly encourages women, minorities and persons with disabilities to compete fully in its programs. In accordance with Federal statutes, regulations and NSF policies, no person on grounds of race, color, age, sex, national origin or disability shall be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving financial assistance from NSF (unless otherwise specified in the eligibility requirements for a particular program).

Facilitation Awards for Scientists and Engineers with Disabilities (FASED) provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF-supported projects. See the program announcement/solicitation for further information.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090, FIRS at 1-800-877-8339.

The National Science Foundation is committed to making all of the information we publish easy to understand. If you have a suggestion about how to improve the clarity of this document or other NSF-published materials, please contact us at plainlanguage@nsf.gov.

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms

will be used in connection with the selection of qualified proposals; project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to applicant institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies needing information as part of the review process or in order to coordinate programs; and to another Federal agency, court or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 63 Federal Register 267 (January 5, 1998), and NSF-51, "Reviewer/Proposal File and Associated Records," 63 Federal Register 268 (January 5, 1998). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

Pursuant to 5 CFR 1320.5(b), an agency may not conduct or sponsor, and a person is not required to respond to an information collection unless it displays a valid OMB control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding this burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to: Suzanne Plimpton, Reports Clearance Officer, Information Dissemination Branch, Division of Administrative Services, National Science Foundation, Arlington, VA 22230, or to Office of Information and Regulatory Affairs of OMB, Attention: Desk Officer for National Science Foundation (3145-0058), 725 17th Street, N.W. Room 10235, Washington, D.C. 20503.

OMB control number: 3145-0058.